

# CLAIMS

1. A Cooled mandrel for winding a band-type product into a coil, comprising a central shaft (1) extending between a rear end connected to rotational driving means round an axis (X'X) and a front end, and a set of adjacent segments (2) mounted to slide radially on said shaft (1) and having curved external faces which connect to form substantially cylindrical a winding surface centred on the axis (X'X) of the central shaft (1), means (3,4) for controlling a variation in diameter of the winding surface, by radial sliding of said segments (2), between an expanded position and a retracted position, and means for cooling the surface of each segment by circulating a heat exchanging fluid comprising, for each segment, a cooling circuit (24, 24') arranged inside said segment (2) and having an inlet orifice (75) and an outlet orifice (75') of the heat exchanging fluid connected each, by means of a fitting of variable length (7,7'), to a fluid supply (5) or exhaust (5') duct, respectively,

characterised in that each supply (5) or exhaust (5') duct, respectively is arranged, at least partially, inside the central shaft (1) and fitted, close to the front end thereof, with a bent portion (52, 52') extending transversally to the longitudinal axis (X'X) and emerging on a lateral face (13') of said shaft (1) via a supply (53) or exhaust (53') transversal orifice, respectively, which is connected sealingly, by at least one fitting of variable length (7, 7'), to at least one inlet (75) or outlet (75') orifice, respectively, of at least one segment (2).
2. A winding mandrel according to claim 1, characterised in that the fittings of variable length (7, 7') linking with the inlet (75) and outlet (75') orifices of each segment (2) are attached to a distribution part (6) in the form of a ring having a concave internal face (61) threaded sealingly on a smooth bearing surface (13') of the lateral face

(13) of the central shaft (1), whereon are provided at least two internal orifices (63, 63') which, in the threaded position of the distribution part (6), are aligned each with a supply (53) or exhaust (53') transversal orifice, respectively, opening  
5 onto said bearing surface (13') of the central shaft (1), in order to form substantially watertight a connection, and an external face (62) whereon are provided, for each segment, two external orifices, respectively supply (64) and exhaust (64') orifices, associated each to a means (71) for plugging a  
10 connection fitting (7) on an inlet (75) or outlet (75') orifice, respectively of the corresponding segment, each external orifice, respectively a supply (53) or exhaust (53') orifice, being connected to an internal orifice, respectively a supply (63) or exhaust (63') orifice, via at least one channel (65)  
15 arranged, at least partially, in the distribution part (6).

3. A winding mandrel according to claim 2, characterised in that it includes, for each segment (2), a pair of ducts, respectively supply (5) and exhaust (5') ducts, arranged inside the central shaft (1) and emerging  
20 respectively, on the lateral face (13) of the shaft (1), via a pair of transversal orifices (53, 53'), that each pair of external orifices, respectively supply (64) and exhaust (64') orifices, corresponding to a segment is connected by two channels (65, 65') arranged in the distribution part (6), to a pair of  
25 internal orifices, respectively supply (63) and exhaust (63') orifices, and that the pairs of internal orifices (63, 63') corresponding to the different segments are distributed, along the internal face (61) of the distribution part (6), similarly to the pairs of transversal orifices (53, 53') on the insertion  
30 bearing surface (13') of the shaft (1), so that, in the threaded position of the distribution part (6), each internal orifice, respectively the supply (63) or exhaust (63') orifice, lies in the extension of a transversal orifice (53, 53') connected to a duct, respectively the supply (5) or exhaust (5') duct, of the  
35 central shaft (1).

4. A winding mandrel according to claim 3, comprising a number (n) of segments (2) having a radial medial plane (P) and extending between two radial junction planes, said radial planes being distributed starwise around the axis (X'X),  
5 characterised in that the central shaft (1) is fitted with (n) pairs of ducts, respectively supply (5) and exhaust (5') ducts, extending symmetrically on both sides of each radial medial plane P and emerging each into the lateral face (13) of the shaft (1) via a transversal orifice (53, 53') having an axis  
10 parallel to said radial medial plane (P) and in that the internal orifices (63, 63') and external orifices (64, 64') of the distribution part (6) are distributed by symmetrical pairs with respect to the radial medial plane (P) of each segment and have axes parallel to said radial medial plane and aligned  
15 with the axes of each corresponding pair of transversal orifices (53, 53') of the insertion bearing surface (13') of the central shaft (1).

5. A winding mandrel according to any of the claims 2, 3, 4 characterised in that the lateral face (13) of the central shaft and the mating internal face (61) of the distribution part  
20 (6) are in the form of cylinders whereof the revolution is centred on the axis (X'X) of the central shaft (1) and having the same diameter, within the assembly clearance, and that the distribution part (6) is mounted slidingly on the insertion  
25 bearing surface (13') of the shaft (1) with interposition of at least two annular sealing joints (16), on both sides of the aligned orifices (52, 65), (52', 65').

6. A winding mandrel according to claim 5, characterised in that the external face (62) of the distribution part (6) includes a plurality of connection facets (62'),  
30 whereof the quantity is equal to the number (n) of segments, fitted each with a pair of external orifices, respectively supply (64) and exhaust (64') orifices, connected to a pair of orifices, respectively inlet (75) and outlet (75') orifices, of the  
35 corresponding segment (2), by a pair of fittings of variable

length (7, 7') having each an internal end and an external end attached respectively to a facet (62') of the distribution part (6) and on a connection facet (73) of the segment (2) whereon are provided the inlet (75) and outlet (75') orifices of the fluid.

7. A winding mandrel according to claim 6, characterised in that the ends, respectively internal and external ends, of the fittings (7, 7') of each pair are attached respectively on the connection facets (62', 73) of the distribution part (6) and of the segment (2), by two plates forming respectively an internal flange (71) and an external flange (71').

8. A winding mandrel according to claim 7, characterised in that the external flange (71') for fastening each pair of fittings (7, 7') on each segment (2) is attached to an intermediate plate (72) attached itself to the connection facet (73) of the segment (2) by screws (76) engaging from the outside.

9. A winding mandrel according to any of the previous claims, comprising a number (n) of segments (2) and wherein the central shaft (1) extends between a rear portion connected to means for driving said shaft into rotation round its axis, and a front portion for supporting the segments (2), characterised in that the radial sliding of the segments is controlled by a rack-type device comprising a tubular sheath (3) mounted to slide axially on the front portion of the central shaft and whereon are arranged at least (n) faces (31) tilted with respect to the axis, co-operating each with a mating tilted face (21) of a corresponding segment (2), for controlling, respectively, the expansion or the retraction of the mandrel by sliding the sheath (3) between two positions, respectively a retracted position and an extended position, under the action of a control rod (4) mounted slidingly parallel to the axis (X'X) of the central shaft (1) and prolonged beyond a front end (12) thereof in order to be attached to a linking

member (40) with the tubular sheath (3), extending transversally before the front end (12) of the central shaft (1).

5 10. A winding mandrel according to claim 9, characterised in that the tubular sheath (3) mounted slidably on the central shaft (1) extends substantially, in its forward position, up to the bearing surface (13') for inserting the distribution part (6), and is prolonged, beyond the latter, by at least two arms (32) running each between two pairs of connection fittings (7, 7') between the distribution part (6) and  
10 both corresponding adjacent segments, each arm (32) being attached, by a front end (33), to the transversal member (40) linking with the sliding control rod (4).

11. A winding mandrel according to claim 10, comprising (n) segments (2) surrounding the central shaft (1),  
15 characterised in that the distribution part (6) comprises (n) watertight connection facets (62'), each of a pair of connection fitting (7, 7'), between which are arranged (n) slipping faces forming each a sliding rest for an arm (32) controlling the tubular sheath (3).

20 12. A winding mandrel according to claim 11, characterised in that the external face (62) of the distribution part (6) has a polygonal shape, the connection facet (62') of the fittings (7, 7') being planar.

25 13. A winding mandrel according to any of the claims 10 to 12, characterised in that the transversal linking member (40) between the control rod (4) and the sheath (3) is composed of a massive part, fitted with a central recess (42) which, at least in a rear position of the control rod (4), is mounted on a centring bearing surface (15), arranged  
30 between the front end (12) of the central shaft (1) and the insertion bearing surface (13') of the distribution part (6).

14. A winding mandrel according to claim 13, characterised in that, the control rod (4) being mounted slidably in an axial bore of the central shaft (1), the central  
35 recess (42) of the transversal linking member (40), is closed

towards the front by a bottom whereon is attached the front end of the control rod.

15. A winding mandrel according to claim 14, characterised in that the linking member (40) is prolonged, 5 towards the front, by a protruding portion (44) forming a axle journal centred on the axis of the central shaft and liable to rest, by means of a bearing (17), on a fixed portion.

16. A winding mandrel according to one of the claims 9 to 15, characterised in that it includes a protection cover (26),  
10 attached removably to the linking member (40) and extending towards the rear, in order to cap the assembly thereof.

17. A winding mandrel according to claim 16, characterised in that each segment (2) is prolonged towards the front by a curved plate (26') having a diameter slightly smaller than that of the cover in order (26) to reach thereinside with a possibility of longitudinal sliding to form substantially continuous a protection.

18. A winding mandrel according to any of the previous claims, characterised in that each segment (2) comprises an internal portion (20') supporting means controlling the radial sliding and an external portion (20) in the form of a cylindrical sector, of welded construction and comprising two curved plates, respectively internal and external, spaced apart from one another in order to provide a free space divided, by at least one wall parallel to the axis, into at least two chambers, respectively supply and exhaust chambers, wherein emerge, respectively, an inlet orifice and an outlet orifice of heat exchanging fluid, arranged in the internal plate of the segment, at an end thereof, said chambers being communicated at the other end of the segment.

19. A winding mandrel according to any of the claims 1 to 17, characterised in that each segment comprises an internal portion (20') supporting means controlling the axial sliding and an external portion (20) in the form of a cylindrical sector, composed of a curved plate (20) in the thickness

whereof are provided a plurality of channels (24, 24') parallel to the axis of the mandrel and distributed over the whole surface of the segment in two series, respectively a supply series (24) and an exhaust series (24'), emerging each, at a front end of the segment, into a distribution chamber (25, 25') integral with the segment (2) and fitted with an inlet orifice (75) or an outlet orifice (75'), respectively of the fluid, the channels (24, 24') of both series being connected to one another, at a rear end of the segment, by a common distribution chamber (23).

20. A winding mandrel according to claim 10, comprising a number (n) of segment and wherein each arm (32) controlling the sliding of the sheath (3) is attached, by a front end (33), to a rear face of the transversal member (40) linking with the control rod (4), characterised in that it includes a circuit for lubrication, at least, tilted faces (31) controlling the sliding of the segments comprising, for each tilted face (31), at least one grease outlet orifice (80), situated at the exit of a pipework (81) extending along the sheath (3) and prolonged by a portion (82) along at least one arm controlling the sliding up to a supply orifice (83) placed on the front end (33) of said arm (32) and connected, by fastening the linking member (40) on said arm (32), on a watertight connection tubing (83'), carried by the linking member (40), and connected to a pressurised grease infeed means (8, 48).

21. A winding mandrel according to claim 20, characterised in that each connection tubing (83) of the lubrication circuit is arranged on a rear face of the linking member (40), whereon applies the front end (33) of the corresponding control arm (32) of the sheath (3) and is placed at the exit of a conduit (84) extending, at least partially, inside the linking member (40), up to a grease infeed orifice (85).

22. A winding mandrel according to claim 21, wherein the control rod is centred on the axis of the mandrel and

attached, by a front end, on a transversal part forming the linking member (40) with the sheath (3), characterised in that the front end of the control rod (4) is fitted with a cylindrical bearing surface (44') which is inserted into a mating bore (44) arranged at the centre of the linking member (40) and wherein emerges at least one grease inlet orifice (85) connected by a conduit (84) to the connection tubing (83') carried by the linking member (40), and that the control rod (4) is fitted with at least one channel (8) extending longitudinally between a rear orifice connected to the grease infeed means (48) and a front orifice arranged on the insertion bearing surface (44') of the control rod, and communicating with the grease inlet orifice emerging into the bore (44) of the linking part (40), after inserting the control rod (4) therein.

23. A winding mandrel according to claim 22, characterised in that the bearing surface (44') for inserting the control rod (4) is fitted with at least one groove (46) which, in the inserted position of the control rod, is situated by the grease infeed orifice (85) opening onto the central bore (44), said groove (46) being surrounded by two annular sealing joints (49).

24. A winding mandrel according to any of the claims 20 to 23, comprising at least two series of tilted faces (31) controlling the radial displacement, respectively, of each segment (2), centred on two mean transversal planes spaced apart longitudinally, each segment (2) being associated with a face of each series, characterised in that the lubrication circuit comprises, for each series of tilted faces (31), at least one pipework (82, 81) extending along a control arm (32), from a supply orifice (83) placed on the front end (33) of said arm (32) up to a fork placed at said series of tilted faces, from which said pipework (81) is divided into at least two branches (86) emerging each into an outlet orifice (80) arranged on one of the tilted faces (31) of said series.



25. A winding mandrel according to any of the claims 23 and 24, characterised in that the tilted faces (31) controlling the radial sliding of the segments (2) are distributed into at least two groups associated each a lubrication circuit, that the control rod is fitted with at least two longitudinal channels (8, 8') emerging each into a groove (46, 46') of the insertion bearing surface (44'), that the central bore of the linking part is fitted with at least two groups of orifices (85) coinciding, in the inserted position, each with a groove (46, 46') of the insertion bearing surface (44'), and connected each to a connection tubing (83'), that the tubular sheath (3) carries at least two groups of pipeworks (82, 81, 81') associated respectively with said groups of tilted faces, each pipework (82) extending along a control arm (32), from a supply orifice (83) connected to one of the connection tubings (83'), up to at least one grease outlet orifice (80) emerging into at least one tilted face (31) of the corresponding group, and that the mandrel is associated with a centralised lubrication system for controlling the pressurised introduction of grease, alternately, in either duct (8, 8') of the control rod (4) and the lubrication of either group of tilted faces (31).